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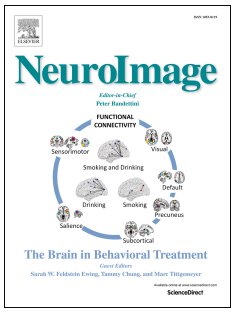

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Estimation of White Matter Fiber Parameters from Compressed Multiresolution Diffusion MRI using Sparse Bayesian Learning

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Abstract

We present a sparse Bayesian unmixing algorithm **BusineX**: **B**ayesian **U**nmixing for **S**parse **In**ference-based **E**stimation of Fiber Crossings (**X**), for estimation of white matter fiber parameters from compressed (under-sampled) diffusion MRI (dMRI) data. BusineX combines compressive sensing with linear unmixing and introduces sparsity to the previously proposed multiresolution data fusion algorithm RubiX, resulting in a method for improved reconstruction, especially from data with lower number of diffusion gradients. We formulate the estimation of fiber parameters as a sparse signal recovery problem and propose a linear unmixing framework with sparse Bayesian learning for the recovery of sparse signals, the fiber orientations and volume fractions. The data is modeled using a parametric spherical deconvolution approach and represented using a dictionary created with the exponential decay components along different possible diffusion directions. Volume fractions of fibers along these directions define the dictionary weights. The proposed sparse inference, which is based on the dictionary representation, considers the sparsity of fiber populations and exploits the spatial redundancy in data representation, thereby facilitating inference from under-sampled q-space. The algorithm improves parameter estimation from

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